Space Weather Technical Forecast

Issued on Wednesday, 27 July 2022 at 13:10 Local

This technical forecast provides a four day assessment of space weather events. The probabilities stated below are for reaching or exceeding the given levels. For more information about space weather impacts please see the Met Office Space Weather Scales https://www.metoffice.gov.uk/weather/learn-about/space-weather/uk-scales

Space Weather Forecast Headline: Chance of G1/Minor Storm intervals day 4 (30th)

Analysis of Space Weather Activity over past 24 hours

Solar Activity: Solar activity has been Low, with a C8 flare observed at 26/1535 UTC from AR3060 which has now rotated off the northwest limb, and a C3-flare observed from just over the southeast limb. There are four numbered sunspot regions on the Earth-facing disc, all of which are small and simple with little sign of growth, along with one very small unnumbered region having also emerged in the southwest. A new region, associated with the C3 flare, may rotate onto the Earth-facing disc during the coming 24 hours. No Earth-directed CMEs were observed.

Solar Wind / Geomagnetic Activity: Solar winds, as measured by DSCOVR and ACE at L1, slowly declined through the period from 520km/s to around 430 km/s as the influence of any recent weak coronal hole or transient enhancement decayed. Density was at or below average. The interplanetary magnetic field (IMF), Bt, was steady, at around 5-7nT, with the Bz variable, but mostly negative (southward pointing) ranging from 5nT to -7nT. The Phi angle was mostly negative (towards the Sun). Geomagnetic activity was Quiet.

Energetic Particles / Solar Radiation: The high energy proton flux (10 MeV), as measured by GOES16 was at Background levels. The High energy electron flux (greater than 2MeV) varied between Moderate and High levels, with a peak of 1230pfu observed at 26/1645UTC, but dropped out to Background from 27/0300 UTC. Electron fluence was below the Active threshold with an observed fluence of 4.14e7 integrated pfu recorded at 27/0000 UTC.

Four-Day Space Weather Forecast Summary

Solar Activity: Solar activity is likely to remain Very Low to Low with only a slight chance of M-class flares.

Solar Wind / Geomagnetic Activity: No CMEs have been assessed as Earth-directed. Solar winds are expected to be slightly elevated, before the arrival of the fast wind of CH04 either late day 3 or day 4 (29th or 30th). No other significant sources of enhancement are anticipated, with geomagnetic activity remaining mostly Quiet with isolated Unsettled spells. This increasing to Unsettled to Active either late day 3 or day 4 (29th or 30th) with a chance of isolated G1/Minor Storm intervals.

Energetic Particles / Solar Radiation: The high energy proton flux (greater than 10 MeV) is expected to remain at Background levels. The high energy electron flux (greater than 2 MeV) is expected to vary between Background and Moderate levels, with the associated 24 hour fluence forecast to remain below the Active threshold (1e8 integrated pfu).

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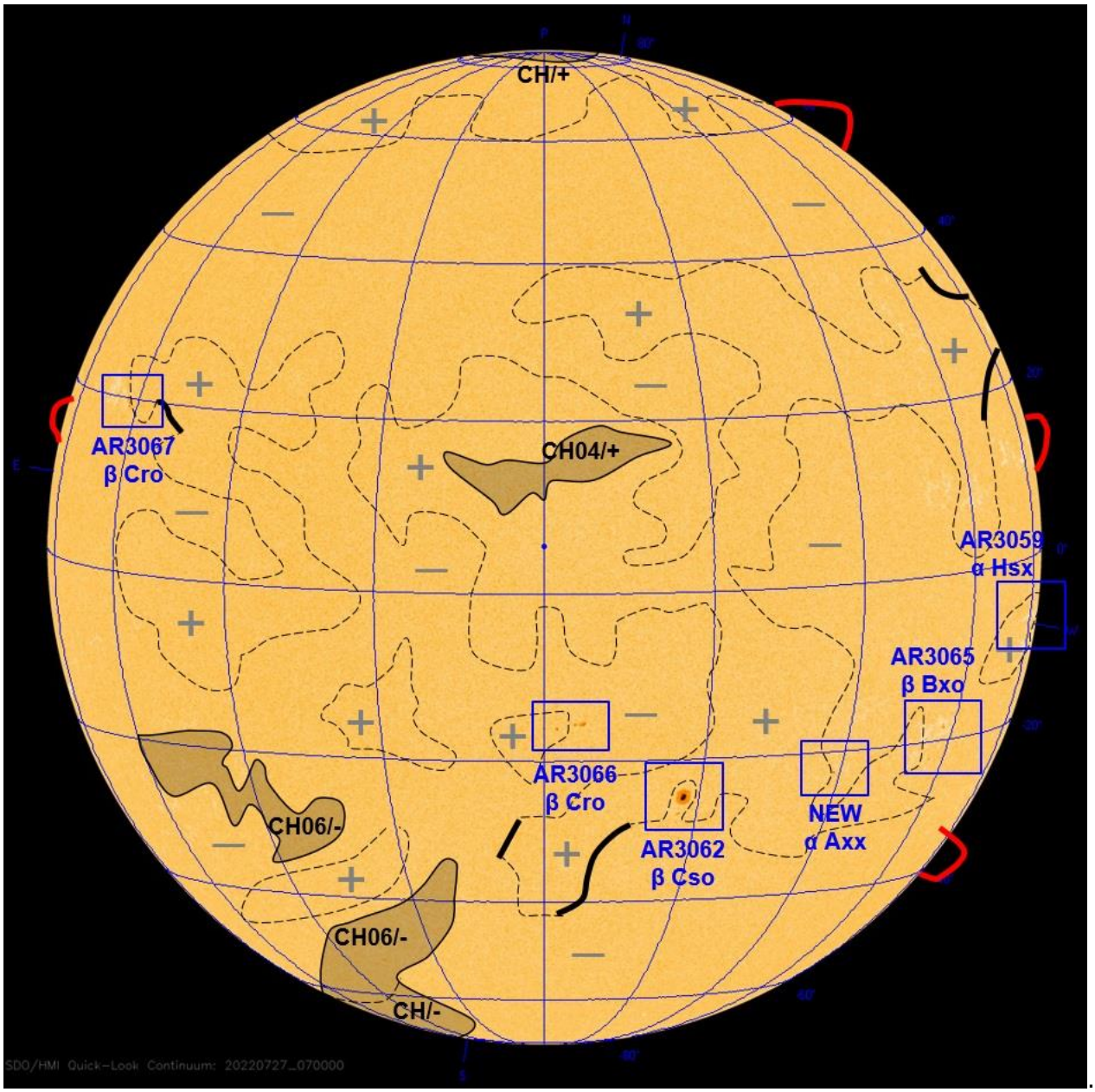
Figure 1. Solar Analysis Valid 27/0800 UTC.



Key: Filament ___ , Prominence ___ , Magnetic Field Line - - - , Polarity +/-, Coronal Holes: Grey shaded area CHxx +/-, Sunspot groups 25xx - Mt Wilson α-β-βγ-βγδ and Zurich-McIntosh Axx etc.

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Geomagnetic Storms:

No CMEs have been assessed as Earth-directed for this period.

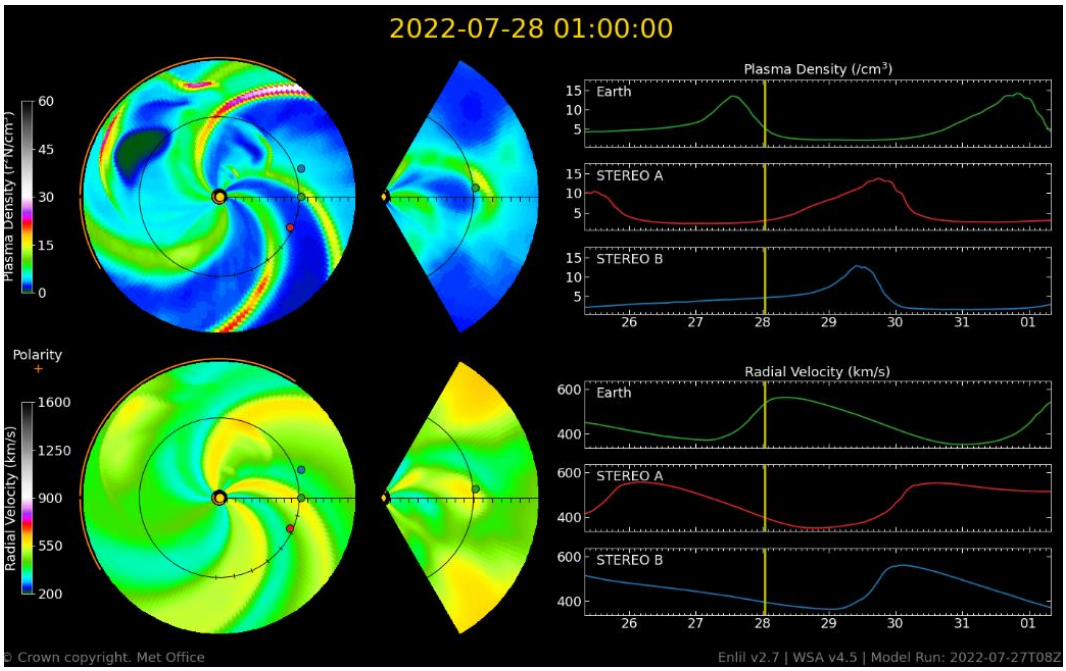
Solar winds are currently slightly elevated at just over 400km/s, and expected to continue at this level. The next coronal hole worth of note is CH04/ It is not a recurring feature so persistence cannot be relied upon, however based on its size and location, its associated fast wind may arrive at the end of day 3 (29th) or (most likely) on day 4 (30th), with speeds estimated to be around 500-550km/s. Enlil suggests a notable enhancement on the 28th, however this is considered too soon.

Geomagnetic activity is forecast to be mainly Quiet with a chance of Unsettled intervals, then to become Unsettled and Active with an outside chance of G1/Minor storms towards the end of day 3 (29th), but more likely on day 4 (30th).

Geo-Magnetic Storm Probability (Exceedance)	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Minor or Moderate	G1 to G2	No	1	1	10	30
Strong	G3	No	1	1	1	1
Severe	G4	No	1	1	1	1
Extreme	G5	No	1	1	1	1

Geomagnetic Activity - Earthbound Coronal Mass Ejections

Figure 2: Enlil showing anticipated enhancement on the 28th, which is currently not expected.



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Radio Blackouts - X-Ray Flares:

Solar activity has been Low, with a C8 flare observed at 26/1535 UTC, although this has now rotated off the northwest limb. There are four numbered sunspot regions on the visible disc, all of which are small and simple, with one small flux emergence in the southwest which has yet to be numbered. No significant growth has been apparent in any of these regions. Far-sided products give a potential for further regions to rotate onto the disc over coming day or two, however confidence is low regarding the size and activity associated with the regions.

Low to Very Low activity is expected to continue through the period, with only a very slight chance of rising to Moderate due to any M-class flares (R1 Radio Blackouts).

X Ray Flares	Level	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC)	Day 2 (00-24 UTC)	Day 3 (00-24 UTC)	Day 4 (00-24 UTC)
Probability			(%)	(%)	(%)	(%)
Active	R1-R2 M Class	No	5	5	5	5
Very Active	R3 to R5 X Class	No	1	1	1	1

Figure 3: GOES16/17 X-ray Flux

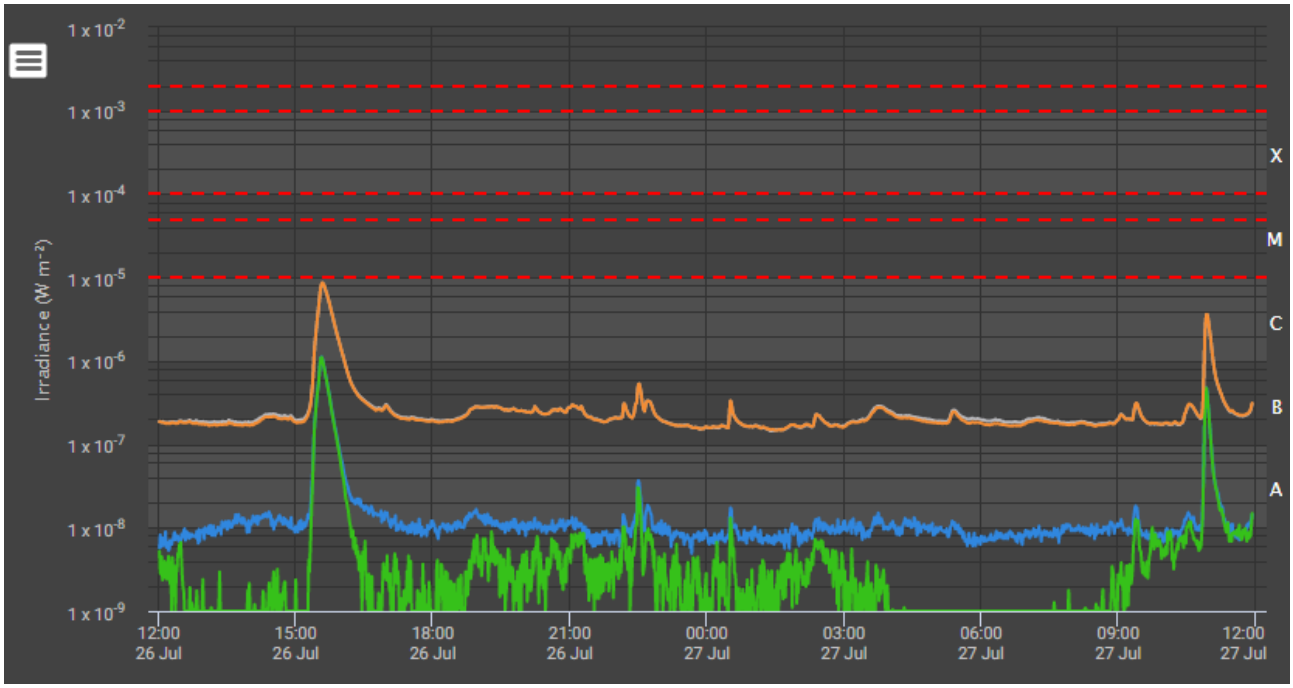

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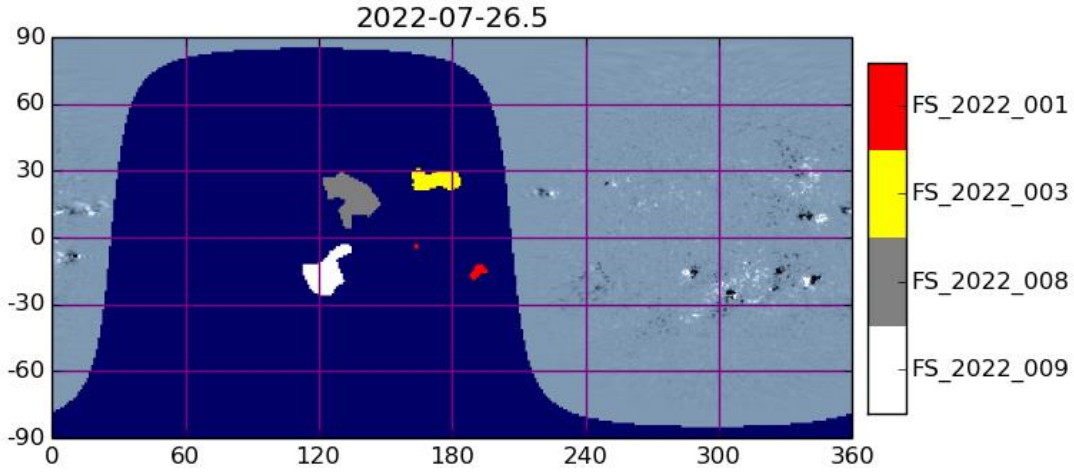
Figure 4: Far-side helioseismic products from jsoc.stanford.edu



Designation	Centroid Longitude (degree)	Centroid Latitude (degree)	Strength	ETA at East Limb (yyyy-mm-dd.d)	Days from East Limb
FS-2022-001	187.4	-14.4	106	2022-07-27.5	1.5
FS-2022-003	172.2	25.3	703	2022-07-28.5	2.5
FS-2022-008	135.0	17.5	1598	2022-07-31.3	5.3
FS-2022-009	123.0	-16.5	1399	2022-08-01.4	6.4

Solar Radiation Storms - (High Energy Protons):

The high energy proton flux (greater than 10 MeV) is currently at Background levels and is currently expected to remain at this level through the period.

Radiation Storms Probability (Exceedance)	Level (cm^{-2} sr^{-1} s^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ S1**	No	1	1	1	1
Very Active	**≥ S3 ***	No	1	1	1	1
* S3 ≥ 10 MeV ≥ 1000 pfu and / or ≥ 50 MeV ≥ 10 pfu. (pfu = $cm^{-2}sr^{-1}s^{-1}$)						

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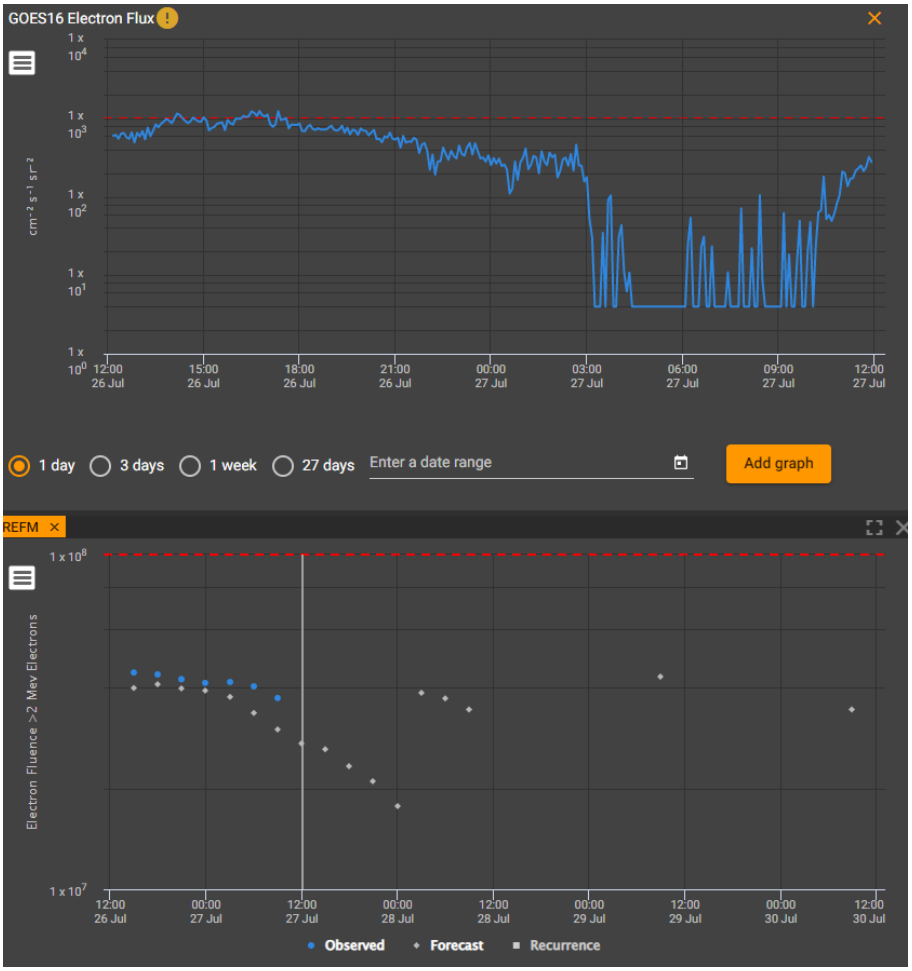
High Energy Electrons Event (≥ 2MeV):

High energy electron flux (greater than 2MeV) as observed by GOES-16 has now fallen to background, and is expected to remain at background to moderate levels through the period with no further notable enhancements expected.

The corresponding 24-hour fluence is expected to remain below the Active threshold through the period, which is supported by REFM.

GEO Electron Environment Probability (Exceedance)	Level (cm^{-2} sr^{-1} day^{-1})	Past 24 Hours (Yes/No)	Day 1 (00-24 UTC) (%)	Day 2 (00-24 UTC) (%)	Day 3 (00-24 UTC) (%)	Day 4 (00-24 UTC) (%)
Active	**≥ 2 MeV ≥ $1x10^8$**	No	1	1	1	1
Very Active	**≥ 2 MeV ≥ $1x10^9$**	No	1	1	1	1

Figure 5: GOES-16 >2MeV Electron Flux and associated fluence with REFM



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